

Contractor shall provide a Quotation demonstrating that equipment proposed will comply with the attached specification. Specifically, the contractor shall include information for key items that are required to perform technical evaluation, as listed below:

Paragraph 5.1:

- A.1 – A.11
- B1
- C.1 – C.5
- D.1 - D.2 and D.4 – D.7
- E.6 - E.7
- F.1 – F.3
- H.1 – H.6
- I.1 - I.2
- K.1 - K.4
- M.1 – M.3, M.6, M.10 – M.14
- N.1
- O.1
- R.1

Additional information on other items is welcome, but not essential for technical evaluation. In the absence of exceptions to technical requirements, it will be understood that the vendor intends to fully comply with the Technical Requirements as listed in the Technical Specification.

Additionally, contractor is requested to forward information on the following areas:

- a. Details on SF6 tank preparation, sealing, testing, field history and historical reliability data.
- b. Type of protection relay proposed for use with fault interrupter; including confirmation that relay will not misoperate due to 10 – 12 per unit inrush current when energizing a 10 MVA transformer.

SPECIFICATION NUMBER: TS050-03, REV. -
DATE: 2 February 2004

Purchase Specification
For The
DD(X) IPS Land Based Test Site

13.8KV, 600A
Outdoor Distribution Switchgear

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1.0 Introduction

This purchase specification and all documents referenced herein contain all of the detailed requirements for (1) 600A, 3 phase, 60 HZ, Dead-Front, Pad Mounted, Six Way, SF6 Insulated, Outdoor Distribution Switchgear nominally rated 13.8KV or higher with switching and protection capabilities as identified in the details section of this specification. The switchgear will be located outdoors at the Naval Surface Warfare Center, Carderock Division, Ship Service Engineering Station (NSWCCD-SSES), Philadelphia Naval Base, Philadelphia, PA.

2.0 Scope

2.1 Equipment and Services to be Provided by the Supplier:

The switchgear (see Figure 1) shall be suitable for industrial installation and shall be constructed in accordance with the best commercial practices. It shall be the Supplier's responsibility to furnish equipment suitable and complete in details for the services intended. The equipment shall be designed, constructed and tested in accordance with applicable regulations of ANSI, IEEE, ASTM, and the National Electrical Code, as specified herein. The Supplier shall be responsible for delivery of each of the following to NSWCCD-SSES in Philadelphia:

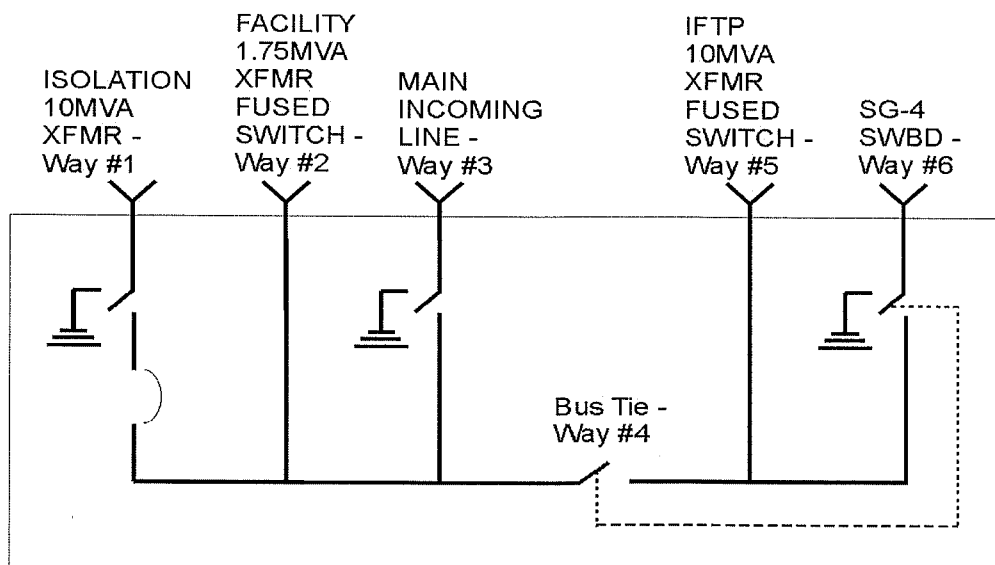
Item	Qty	Description
0001	1	Switchgear, Outdoor, Pad Mounted, Six Way, 13.8 KVAC, 60Hz
0002	1	Drawing Approval Documentation (Section 4.0)
0003	3	Technical Manual (Section 6.2)

The Technical Requirements for this Switchgear are listed in Tabular Format in Section 5.0. The Quotation forwarded in response to this Purchase Specification should address key Technical Requirement line items as specified in the cover letter. All other technical items are required as part of this contract.

2.2 Equipment and Services to be Provided by the Government:

The Government shall install the Switchgear and shall be responsible for the following items:

1. Mounting foundations, structural components and mounting bolts attaching the Supplier-furnished equipment to the site structure, and,
2. Associated cabling.



Way#	Load Description	Summary Requirements
1	Isolation XFMR	600 A Load Interrupter, with grounding capability. 600 A Fault Interrupter.
2	Facility XFMR	600 A Tap
3	Main Incoming Line	600 A Load Interrupter with grounding capability. Remote Motor Operation capability.
4	Bus Tie	600 A Load Interrupter without grounding capability.
5	IFTF XFMR	600 A Tap
6	SG-4 SWBD	600 A Load Interrupter with grounding capability

NOTES:

1. All cable connections are in rear of unit.
2. Switching operations are carried out at front or front top of unit.
3. Unit has dead front design.
4. Diagram shows physical representation of switch positions. For example, Isolation XFMR Switch with Vacuum Interrupter are in the left most position (way 1 position) when looking at front of unit. Position 6 for SG-4 SWBD is in the far right position (way 6 position) when looking at front of unit.
5. Bus Tie Switch and SG-4 Switch shall be key interlocked to prevent closure of both switches at the same time.
6. See Section 5 for additional technical requirements.
7. The 10MVA Isolation Transformer has its 13.2KV delta configured winding connected to the Outdoor Distribution Switchgear and its 13.8KV wye configured winding connected to supply two different Government provided Switchboards. Supplier to verify the vacuum interrupter will not cause transient voltage issues when isolating the 10MVA Isolation Transformer. Distribution system on secondary side (wye side) of transformer is high resistance grounded.

Figure 1 – Outdoor Distribution Switchgear One Line Diagram & Summary Table

3.0 Applicable Documents

- NFPA-70, National Electrical Code, 2002 - Article 490
- ANSI C37.72-1987, Manually Operated, Dead Front Pad Mounted Switchgear with Load Interrupting Switches and Separable Connectors for Alternating Current Systems
- IEEE 386-1995, Standard for Separable Insulated Connector Systems for Power Distribution Systems above 600V
- ASTM D2472-2000, Standard Specification for Sulfur Hexafluoride
- ANSI C57.12.28-1999, Pad Mounted Equipment - Enclosure Integrity

4.0 Drawing Approval

The Supplier shall submit the following documents to the Government, for approval, prior to obtaining Drawing Approval:

- Final Outline, Detail, and Electrical Drawings (Section 6.1)
- Switchgear – Transformer Coordination analysis.
- List of Special Tools / Equipment that will be necessary to put equipment in service

5.0 Technical Requirements

5.1 Outdoor Distribution Switchgear

<p>A. Minimum Integrated Electrical Ratings (includes switches, busses, vacuum interrupters, and bushings):</p>	<ol style="list-style-type: none"> 1. All switches and interrupters shall be rated 600A continuous and have full load break and full load make capability. 2. All switches and interrupters are rated for 3 phase, ganged operation. 3. Equipment shall be designed for 60Hz operation. 4. Equipment will be utilized on a 13.8KV nominal rated system. Equipment shall be rated for 15.5KV minimum phase to phase and phase to ground. 5. Equipment shall have a minimum 95KV BIL rating. 6. The switches, busses, interrupters, bushings, etc. shall be rated to carry 25,000A symmetrical RMS and 40,000A asymmetrical RMS fault current for at least 10 cycles. 7. The switches, busses, fault interrupters, bushings, etc. shall safely withstand the affects of closing into, and carrying rated fault currents. 8. The switches, busses, interrupters, bushings, etc. shall be capable of thermally withstanding 25,000A symmetrical RMS fault current for at least 1 second. 9. The interrupter shall be capable of making and interrupting all currents up to the maximum short circuit rating of 40,000A asymmetrical RMS at maximum rated voltage. 10. Open gaps of the switches shall be sized to allow cable testing thru the back of the elbow. 11. Open gaps of switches and fault interrupters shall be sized to provide reliable isolation from equipment out of service and between power sources that could be out of phase from one another.
<p>B. Harmonic Currents:</p>	<ol style="list-style-type: none"> 1. In addition to carrying sinusoidal, 60Hz load current; the switchgear shall be capable of supporting harmonic current profiles without misoperation. The worst case expected harmonic load currents are as specified: 5th = .2152pu, 7th = .0734, 11th = .0612pu, 13th = .0389pu, 17th = .0259 pu, 19th = .0209pu, 23rd = .0101pu, 25th = .0094pu. Note: 1pu = 437 A.
<p>C. SF6 Gas / Tank:</p>	<ol style="list-style-type: none"> 1. A welded stainless steel switch tank of at least 7 gauge thickness shall be provided. 2. Tank shall be filled with SF6 gas conforming to ASTM D 2472 prior to shipment. 3. Switchgear shall be capable of withstanding low or

	<p>loss of SF6 pressure at expected operating temperatures.</p> <ol style="list-style-type: none"> 4. An SF6 fill valve and pressure gage shall be provided in the switching compartment area. 5. An SF6 low pressure alarm switch with auxiliary contacts (SPDT) rated for 120VAC / 125VDC shall be provided for remote alarm capability.
D. Operating Mechanisms:	<ol style="list-style-type: none"> 1. All operation shafts shall be located on the opposite side of gear from where the 13.8KV power bushings are located so that routine operations are not performed in close proximity to 13.8KV elbows and cables. 2. Load interrupter switches and fault interrupters shall be operated by means of a quick make, quick break mechanism. 3. The manual handle shall charge the operating mechanism for opening, closing, and grounding of the switches and fault interrupters. The charging mechanism shall provide switch and interrupter contacts with the required operating speed which is independent of operator handle speed. 4. Operating mechanisms shall be equipped with an operation selector to prevent inadvertent operation from the closed position directly to the grounded position, or from the grounded position directly to the closed position. The operation selector shall require physical movement to the proper position to permit the next operation. 5. Operation shafts shall be padlockable in any position. 6. The operation selector shall be padlockable to prevent operation to the grounded position. 7. The operating mechanism shall indicate switch position which shall be clearly visible from the normal operating position.
E. Indicators:	<ol style="list-style-type: none"> 1. All indicators shall be located on the opposite side of gear from where the 13.8KV power bushings are located so that routine operations are not performed in close proximity to 13.8KV elbows and cables. 2. Each load interrupter switch shall have a viewing window to see the position of the switch contacts (open, closed, grounded). Note: The bus tie switch shall not have a grounding position. 3. The fault interrupter shall have an indicator showing the position of its contacts. 4. The fault interrupter shall come with a load interrupter switch which shall have a viewing window to see the

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	<p>position of its switch contacts (open, closed, grounded).</p> <ol style="list-style-type: none"> 5. A cover shall be provided for each viewing window to suppress any switching related arcs. 6. Voltage indication with provisions for low voltage phasing for each load interrupter switch and fault interrupter shall be provided. This feature shall include a display to indicate presence of voltage. Note: These provisions are not required for the Switchgear Ways that only have Cable Tap connections. Control power for the test feature can be self derived or customer provided. 7. All load switches and fault interrupters shall have an auxiliary switch available (120VAC / VDC, SPDT) for remote indication of their main contact position.
F. Installation Location/ Enclosure Type:	<ol style="list-style-type: none"> 1. Outdoor (assuming humidity conditions between 0 % and 100 %), NEMA 3R. 2. Pad mounted, non walk-in enclosure for installation on a concrete pad. 3. Enclosure shall provide clear access to bushings for cable terminations. Enclosure may be detachable from the switchgear to provide required access to termination area. 4. Lifting eyes shall be provided. 5. The enclosure shall be constructed of 14 gauge minimum thickness sheet steel. 6. Enclosure surface shall be properly prepared and shall be provided with an ANSI 61 light gray outdoor paint finish having a minimum thickness of 3 mils. Provide description of preparation and painting process for buyer review. 7. The enclosure shall be padlockable. 8. Compartment doors shall have a positive means of latching in the open position.
G. Identification:	<ol style="list-style-type: none"> 1. The switchgear shall have an equipment rating nameplate installed in accordance with the referenced standards. 2. Each switchgear way shall have a white lamicoid (white background) with black core (black letters) indicating the Way # and Load Description as listed in the Figure 1 Summary Table.
H. 15KV Cable Entry/ Terminations:	<ol style="list-style-type: none"> 1. Cables will enter bottom rear of enclosure. 2. At least 25" of depth shall be provided in the cable entry compartment. 3. 600A bushings shall be provided for connecting IEEE 386 insulated connectors at all terminations.

	<ol style="list-style-type: none"> 4. Bushings shall have a centerline height of approximately 40" above the base of the switchgear. This dimension will satisfy minimum cable entry bending requirements. If required, a base spacer under the standard switchgear base may be added to accommodate this height dimension. 5. Sufficient termination space and bushing area strength shall be provided to accommodate connection of up to two 15KV, shielded 500MCM Copper, EPR insulated, PVC or hypalon jacketed cables per phase at each bushing using IEEE 386 connectors. 6. Terminations shall be rated for cable operation at 90 degrees C minimum.
I. High Voltage Bus:	<ol style="list-style-type: none"> 1. Busses shall be copper. The copper shall be silver plated or treated in another customer approved means in areas where internal or external electrical connections are made. 2. The Busses shall be designed to withstand the maximum short circuit forces based on the rating of the switchgear.
J. Ground Bus:	<ol style="list-style-type: none"> 1. Ground bus or ground pad shall be provided which is suitable to accommodate up to two ground cables for each Switch Way. 2. Ground bus or ground pad shall accommodate ½" Nema compression lugs for 2/0 thru 500MCM copper. 3. The ground bus and its connection to the switchgear shall have a short circuit rating equal to the switchgear.
K. Interlocking:	<ol style="list-style-type: none"> 1. Way #4 (Bus Tie) and Way #6 (SG-4 Swbd) shall be key interlocked to prevent these two load break switches from being closed simultaneously. 2. Each interlocked load break switch position shall have a non-removable lock. Removable padlocks are not acceptable for interlocking load break switches. 3. A key shall be provided for the switchgear that will fit into and operate Way #4 and Way #6 load break switch locks. Each switch lock will retain the key until after the switch is opened and the key is returned to the non-operating position. With the switch open and the lock in the non-operating position, the key can be removed. The key can then be placed in the other switch lock, the switch lock could be operated and then this would allow this switch to be closed. This design allows only Way #4 or Way #6 to be closed at any given time. Four sets of interlock keys shall be provided.

	<ol style="list-style-type: none"> 4. Local Warning Placards shall be installed adjacent to Way 4 and Way 6 to alert the operator not to attempt to close Way 4 if Way 6 is closed and vice versa.
L. Main Incoming Line:	<ol style="list-style-type: none"> 1. The main incoming line switch way shall be provided with a motor operator that can be operated remotely. Customer provided 120vac will be made available to power the battery system that comes with the motor operator. The battery system provided shall also be designed to provide for other reliable switchgear power requirements as specified herein. The motor operator shall have the capability of being moved to another switch position in the future if desired.
M. Vacuum Fault Interrupter/ Over Current Protection:	<ol style="list-style-type: none"> 1. 600A capability with non-fused (resettable) over current protection in each of the (3) phases is required. 2. Residual ground over current protection capability shall also be provided. 3. The over current device shall be field programmable via a personal computer. It shall be possible to select time and instantaneous over current trip functions or time only for the over current protection provided. 4. Programming cable and any other interface hardware for over current device shall be provided. 5. The over current device shall send a trip signal to the vacuum interrupter if over current settings have been exceeded. 6. Power and sensing for the over current device and resultant tripping of the vacuum interrupter shall be supplied from the integral current transformers. 7. The vacuum interrupter and its protective circuits shall be provided with provision to trip the vacuum interrupter from a reliable battery power source provided with the switchgear. 8. The vacuum interrupter shall be field resettable after a trip. 9. The vacuum interrupter shall have a minimum clearing time of 3 cycles from fault initiation to fault clearing. 10. The vacuum interrupter way shall have (3) wye connected current transformers and a transformer differential relay with manual reset lockout provided that can be utilized with (6) remote Government provided current transformers which will provide differential protection to the 10 MVA isolation transformer. The transformer differential relay and lockout relay should be located in the switchgear low voltage compartment. These items shall be internally

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	<p>wired as part of the 10 MVA isolation transformer current differential protection package which trips the vacuum interrupter.</p> <p>11. The required terminal block space shall be provided for connecting the six remote Government provided 10 MVA isolation transformer differential CTs in the low voltage compartment. Six Government provided CTs will be utilized because there will be two output breakers with transformer differential CTs on the 13.8 KV (wye) side winding of the 10 MVA isolation transformer. Each breaker will utilize 1 CT on each phase as part of the transformer differential protection. Note: Only one output breaker will be closed at a time.</p>
N. Main Incoming Line Side PT's & CT's	<p>1. (3) CT'S and (2) fused open delta PT's shall be provided for metering as described below.</p>
O. Line Side Metering:	<p>1. A Multifunction Power Meter will be provided by the Government to interface with the voltage and current signals from the Switchgear Utility Power interface (Way 3). The Power Meter will be a Cutler Hammer 1QDP4130. PTs shall be fused on the primary and secondary. CTs shall have a terminal board with shorting capability. PTs shall provide a 3 phase, 120 V secondary and have 1 leg referenced to ground. CTs shall have a 5 A secondary.</p>
P. Low Voltage Wiring:	<p>1. Minimum 90 degrees C, 600V insulated type SIS, with copper conductor shall be provided.</p> <p>2. A separate compartment(s) shall be provided for all Government low voltage wiring interfaces which would include interfaces such as: remote operation of switch motor for main incoming line, transformer differential CT's for Way #1, SF6 low pressure alarm, metering alarms, remote tripping of the vacuum interrupter, remote indication of load switch and fault interrupter main contact position, Government provided auxiliary power.</p> <p>3. Space provision shall be provided for future customer installation of the Cutler Hammer Power Meter following delivery of the switchgear.</p> <p>4. Provision shall be provided that allows low voltage circuits to be supplied from both below the low voltage wiring compartment as well as from the lower side of the wiring compartment. The lower side wiring option will allow cable entry from an above ground route if desired.</p>

Q. Compartment Space Heater (if reqd):	<ol style="list-style-type: none"> 1. Space heaters with thermostat control shall be provided to prevent condensation in any compartments that will be negatively impacted by moisture. 2. If heaters are required, heater power can be derived from a Government provided ungrounded 120 VAC source. The Government would provide a 120 VAC source that could be used to power the motor operator circuit as well as the heaters. The Supplier is required to provide current limiting fuses downstream of the Government provided 120 VAC power source connection to isolate the motor operator power from the heater power in case of a load fault.
R. Maximum Dimensions:	<ol style="list-style-type: none"> 1. 126" wide x 80" high x 80" deep

5.2 Testing

A. Dielectric:	Rated power frequency and DC withstand dielectric tests shall be conducted in accordance with ANSI C37.72 on the switchgear provided. Applicable dielectric tests shall also be provided for the CT's, PT's, and low voltage wiring.
B. Operation:	The switchgear components shall be functionally tested to verify proper operation. This includes but is not limited to opening and closing all switches and interrupters, verifying all indicators, interlocks, as well as protective and operating circuits are working properly. Tests shall be conducted in accordance with ANSI C37.72.
C. Leak Test:	Sealed tanks shall be tested to insure that no leaks are present that will impair operation of the equipment over its operating life.
D. Metering including CT's and PT's	Metering related components shall be tested to verify proper operation and calibration. Calibration certificates for any seller furnished instrumentation shall be provided with switchgear.
E. Contact Resistances:	Bus bar joints and contact resistances shall be tested with a digital low resistance ohmmeter or equal to verify integrity.
F. Design Tests:	Shall be performed as necessary to verify the switch meets or exceeds this specification and as outlined in ANSI C37.72.

6.0 Technical Data

6.1 Drawings

Final Outline, Detail, and Electrical Drawings are required to include the following information:

- Mounting dimensions, rigging features, space limitations, location of center of gravity, switchgear weight with and without enclosure if enclosure is removable from remaining part of switchgear for installation.
- Customer interface locations, electrical schematics, wiring diagrams, one line diagrams.
- Nameplate data.
- Time vs current coordination plot for vacuum interrupter protection of 10MVA Transformer. The Supplier shall verify, using time-current characteristic curves for the over current device that the transformer magnetizing current and duration does not damage any part of the switchgear or cause the interrupter to trip during energization of the 10 MVA transformer. Specific transformer inrush data to be provided by the Government during detailed design.
- CT requirements for remote Government provided isolation transformer differential CTs. The Supplier shall provide documentation showing requirements for the remote Government provided current transformers which will provide differential protection to the 10 MVA isolation transformer to insure proper system operation. The remote Government differential CTs may be located up to 250' from the switchgear and will be interconnected to the CT's using #10AWG wiring.

The drawings shall be included in the Technical Manual (6.2). The Government will also approve the Suppliers Drawings to obtain a release for manufacture.

6.2 Technical Manuals

Three sets of technical manuals shall be forwarded not later than the delivery date of the equipment. Technical manuals shall contain required technical data including: Drawings (6.1), Special Tools / Equipment (6.3), Recommended Maintenance (6.4), Certified Test Report (5.2), instruction manual for overcurrent device and differential relay and any other technical information required to install, operate, or maintain the switchgear.

6.3 Special Tools / Equipment

A list of special tools / equipment required to put transformer in service shall be provided for Release to Manufacture and shall be included in the Technical Manual. Any programming software or interface equipment required for programming protection relays shall be provided.

6.4 Recommended Maintenance

Recommendations shall be provided on the maintenance to be performed and the frequency of maintenance actions for the equipment specified in this document. Also a recommended spare parts list with pricing shall be included with the maintenance

recommendations. This information shall be provided in the Technical Manual not later than the delivery date of the equipment.

7.0 Inspection and Testing

Testing of the equipment shall be performed by the Supplier as specified in Section 5.2. The Government reserves the right to witness Supplier testing and to perform equipment inspections where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

8.0 Shipping

8.1 Packaging

Equipment shall be packed for shipping in a manner which will ensure acceptance and safe delivery at destination. Supplier is responsible for damage during shipment.

8.2 Marking

Each package shall be marked with the Contract Number, Contract Item Number and Purchase Specification Number TS050-03.

8.3 Delivery

All equipment and technical data specified in this document shall be delivered to NSWCCD-SSES in accordance with the following schedule:

- Item 0001: Within 15 weeks after contract award or within 10 weeks after Drawing Approval, whichever is later.
- Item 0002: Within 3 weeks after contract award.
Note: NSWC shall be given 2 weeks to review and provide Drawing Approval
- Item 0003: Within 15 weeks after contract award

All deliverables shall be forwarded to the address given below:

Commander
Naval Surface Warfare Center Carderock Division
Naval Business Center Bldg 542
Philadelphia, PA 19112-5083
Attn: Mr. Ed Harvey, Code 934